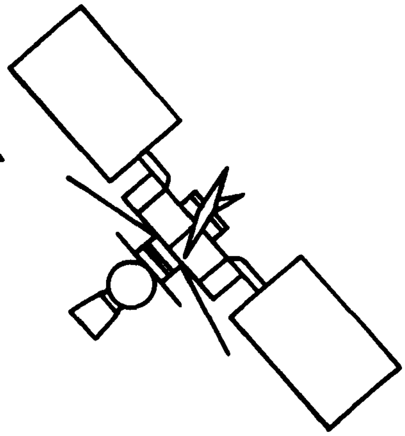
PRESS KIT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

TELS. WO 2-4155
WO 3-6925

FOR RELEASE: THURSDAY P.M.
July 13, 1967

RELEASE NO: 67-178



PROJECT: Interplanetary Monitoring Platform-E (IMP-E)

(To be launched no earlier than July 19, 1967)

CONTENTS

-end-

NEWS
NASA
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546
TELS. WO 2-4155
WO 3-6925

FOR RELEASE: THURSDAY P.M.
July 13, 1967

RELEASE NO: 67-178

IMP-E LAUNCH
SET JULY 19
AT CAPE KENNEDY

A scientific laboratory, designed to study interplanetary space phenomena in the vicinity of the Moon, is scheduled for launch by the National Aeronautics and Space Administration no earlier than July 19 from Cape Kennedy, Fla.

The 230-pound spacecraft is the Interplanetary Monitoring Platform-E (IMP-E), to be renamed Explorer XXXV in orbit. It will be the sixth IMP launched and the second one designed to collect data at lunar distances. IMP-D (Explorer XXXIII) was launched on July 1, 1966, and placed in a highly-elliptical Earth orbit which carries the spacecraft beyond the distance to the Moon and back.

The primary mission objective of the IMP-E is to study the solar wind and interplanetary magnetic field at lunar distances and their interaction with the Moon. This can be accomplished by orbiting the spacecraft around the Moon or by placing it in an Earth orbit with an apogee near or beyond the vicinity of the Moon.

-more-

Attainment of a lunar orbit would permit the secondary objectives of the IMP-E mission to be met. These include the collection of data on the dust distributions around the Moon, the lunar gravitational field, the weak lunar ionosphere and the radiation environment.

Placing the IMP-E into orbit around the Moon anchors it in interplanetary space and provides for the collection of data over extended periods of time away from the influence of the Earth's magnetic field. (The lunar magnetic field is about 1,000 times weaker than that of the Earth.) Additionally, the Moon's orbit would take IMP-E through the Earth's magnetic tail once each lunar month (29.5 days) as compared to once a year possible from highly-elliptical Earth orbits.

The launch vehicle employed for the IMP-E mission is the three-stage thrust augmented Delta rocket. A small thrust retromotor, mounted on top of IMP-E, will be fired by command at the direction of the mission control director at Goddard Space Flight Center, Greenbelt, Md. This will either make it possible for the Moon's gravitational field to capture the spacecraft or limit IMP-E's apogee to near-lunar distances.

-more-

Since no trajectory adjustment will be made during the planned 72-hour flight to the vicinity of the Moon, the flight trajectory must be exceedingly precise and the performance of the Delta rocket flawless if lunar orbit is to be attained. The trajectory goal limits the launching window to a daily three-minute period between July 19 and 22. This is one of the shortest launch periods for U.S. rocket missions.

A decision to try for a lunar orbit will be made about six hours after liftoff when the performance of the Delta's three stages can be evaluated. The probability of attaining a lunar orbit has been enhanced by an improved launch trajectory and the addition of an attitude control system to IMP-E.

The attitude control system will be used to reorient the spacecraft and its retromotor if this maneuver is required to obtain a lunar orbit or an improved lunar orbit. It can also be used to orient the spacecraft in its final orbit for the benefit of the solar arrays and experiments.

If all goes well for a lunar orbit, the spacecraft will attain a lunar orbit with an apolune or high point above the Moon of less than 28,500 statute miles and a perilune greater than 300 statute miles.

The orbit period will be between 10 and 70 hours depending upon the orbit achieved. The orbit will be inclined between 140 to 180 degrees to the Moon's equator.

If placed into an elliptical Earth orbit, IMP-E would circle the globe no more than once every two weeks with an apogee in the vicinity of 280,000 miles and a perigee of approximately 18,700 miles. The path of this orbit would be inclined initially 28 to 33 degrees to the Earth's equator.

With IMP-E in a lunar orbit, data from this spacecraft can be correlated with that from Explorers XXXIII and XXXIV, two IMP-type spacecraft now in Earth orbit. This would offer an opportunity to separate the effects of the Sun on the Earth's magnetosphere from time effects on it. The magnetosphere is an envelope formed by the interaction of the solar wind with the Earth's magnetic field.

Valuable information about the effects of solar events on the Earth's environment has already been obtained by Explorer XXXIII (IMP-D) and other IMP satellites along with Orbiting Geophysical Observatory (OGO) spacecraft. Data from these spacecraft are also useful in determining the radiation and micrometeorite levels to be expected during Apollo flights to the Moon as well as aiding in the eventual development of a solar flare prediction capability for that program.

-more-

The IMP-E payload consists of seven scientific experiments, two passive experiments, and one engineering experiment--a solar cell damage study. These were provided by scientists from the University of California, Berkeley; the University of Iowa, Iowa City; Stanford University, Palo Alto, Calif.; the Massachusetts Institute of Technology, Cambridge, Mass.; Temple University, Philadelphia; NASA's Ames Research Center, Mountain View, Cal., and Goddard Space Flight Center, Greenbelt, Md.

Wherever possible, handling of all spacecraft components--as well as the fully assembled spacecraft--has been under strict cleanroom conditions. Decontamination controls and procedures for the IMP-E have been highly effective resulting in the attainment of the lowest level of contamination of any spacecraft fabricated for any flight program to date. In addition, every effort has been made to make IMP-E magnetically clean.

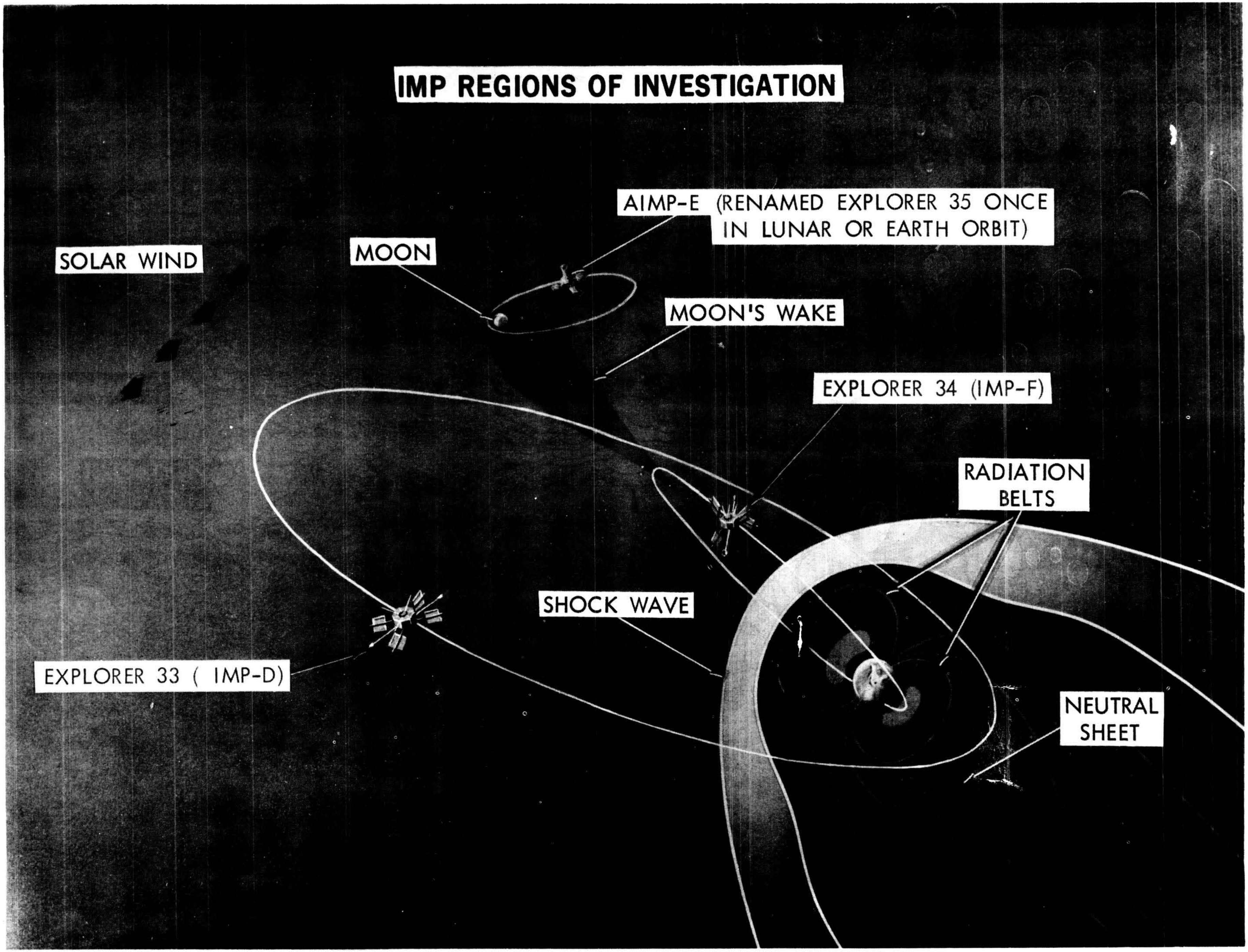
The launching will be the 50th flight for the Delta Launch Vehicle. To date, Delta has achieved orbit 46 times out of 49 attempts.

It will be the 14th flight for NASA's Thrust-Augmented Improved Delta which has the capability of hurling almost three times more weight into orbit than the earlier Deltas.

The IMP spacecraft are part of the scientific space exploration program conducted by NASA's Office of Space Science and Applications.

Project technical management for both programs is directed by the Goddard Space Flight Center. The design, fabrication and experiment integration of these spacecraft is conducted at Goddard with limited contractor support.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS)


IMP REGIONS OF INVESTIGATION
AIMP-E (RENAMED EXPLORER 35 ONCE IN LUNAR OR EARTH ORBIT)
SOLAR WIND
MOON
MOON'S WAKE
EXPLORER 34 (IMP-F)
RADIATION BELTS
SHOCK WAVE
EXPLORER 33 (IMP-D)
NEUTRAL SHEET

THE FLIGHT PLAN

The three minute launch window opens at the following times for the indicated days:

19th - 10:19 a.m. EDT
20th - 11:18 a.m. EDT
21st - 12:14 p.m. EDT
22nd - 1:09 p.m. EDT

After liftoff, the Delta Launch Vehicle will be shooting at a target well ahead of the Moon. Orbital insertion should occur 72 hours after liftoff, about 3,000 miles ahead of the Moon when the retromotor is fired.

The purpose of the retromotor is to decelerate the spacecraft as it approaches the Moon to a velocity slow enough to allow it to be captured by the Moon's gravitational field, or to slow the spacecraft so that the apogee in an Earth orbit is about 280,000 miles.

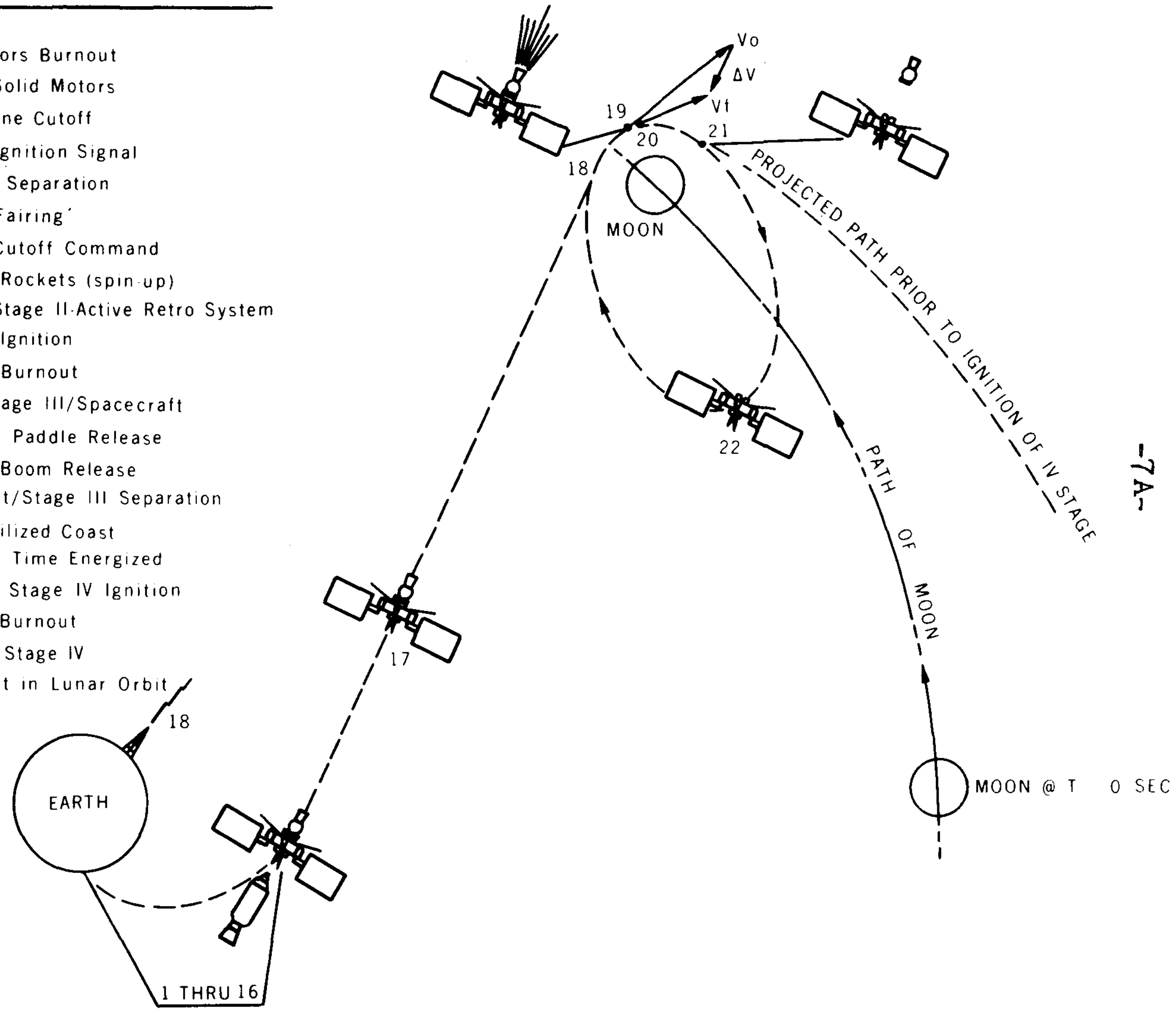
Goddard's IMP-E Control Center will determine the time of firing the retromotor about five or six hours after launching. Nominal burn time of the motor is about 20 seconds and it develops a thrust of about 916 pounds.

About two hours after burnout, the retromotor will be separated from the spacecraft either by ground command or by an automatic jettison system.

ANCHORED IMP LAUNCH SEQUENCE

Sequence No	Time/sec	Event
1	0	Liftoff
2	43	Solid Motors Burnout
3	70	Jettison Solid Motors
4	149	Main Engine Cutoff
5	153	Stage II Ignition Signal
6	154	Stage I/II Separation
7	216	Jettison Fairing
8	533	Stage II Cutoff Command
9	1315	Fire Spin Rockets (spin-up)
10	1317	Jettison Stage II-Active Retro System
11	1330	Stage III Ignition
12	1361	Stage III Burnout
13	1390	Despin Stage III/Spacecraft
14	1405	Solar Cell Paddle Release
15	1415	Flux-gate Boom Release
16	1445	Spacecraft/Stage III Separation
17		Spin Stabilized Coast
18	DBC	Command Time Energized
19	DBC+T	Command Stage IV Ignition
20	DBC+T+22	Stage IV Burnout
21	DBC+T+720C	Separate Stage IV
22	72 Hours After Liftoff	Spacecraft in Lunar Orbit

T = Timer
DBC = Determined By Computer



-more-

NASA G-67- 9726

THE SPACECRAFT

The 230-pound IMP-E spacecraft resembles the earlier Goddard-designed and built Interplanetary Monitoring Platform (IMP) spacecraft. The primary difference is an 82-pound retromotor located on the top of the octagon-shaped main body of IMP-E. The standard IMP spacecraft, with the exception of the IMP-F (Explorer XXXIV) carried a ball-shaped rubidium vapor magnetometer at the end of an extendable boom in this location. Additionally, the transmitting antennas are nearer to the outer edge of the main body top cover on IMP-E.

The spin-stabilized IMP-E carries an optical aspect sensor capable of sensing the Moon or the Earth and the Sun to determine the spin axis to plus or minus 5/10ths of a degree.

Five of the seven experiments carried by IMP-E as well as the spacecraft's mechanical and electrical systems are housed inside the 28-inch diameter by a seven-inch high main body. The remaining two experiments, fluxgate magnetometers, are carried on two booms extending about seven feet out from the main body.

Spacecraft Communications System

The IMP-E communications system provides a radio link between the spacecraft and Goddard's worldwide Space Tracking and Data Acquisition Network (STADAN). This link will be used by the spacecraft for receiving ground-based commands as well as range and range-rate signals. It will also be used for transmitting experiment and spacecraft housekeeping data from the spacecraft back to Earth.

Transmitted power will be at least seven watts which is capable of covering the distance between the Moon and the Earth. The telemetry transmitter operates on a frequency of 136:110 megahertz.

Power Supply

Like most unmanned spacecraft, the IMP-E operates on solar power. Energy from the Sun is collected by 7,680 solar cells located on four solar arrays attached to the main spacecraft body. This system provides the power (38 watts average) required to operate the spacecraft systems and the experiments.

Included in the power supply system is a battery pack to provide energy when the spacecraft is not in the sunlight. The battery is a sealed nonmagnetic silver-cadmium battery composed of 13 cells connected in series. It has an 11 ampere-hour storage capability. This is sufficient to operate the spacecraft and its experiments for three and a half hours without recharge.

Attitude Control System

A cold gas (Freon 14) attitude control system is carried onboard the IMP-E. This system, operated by ground command, might be used to reorient the spacecraft along with the fourth stage prior to ignition if required to achieve lunar orbit or an enhanced Earth orbit. It will also be used to orient the spacecraft once it is in lunar orbit. This system is new to the IMP spacecraft.

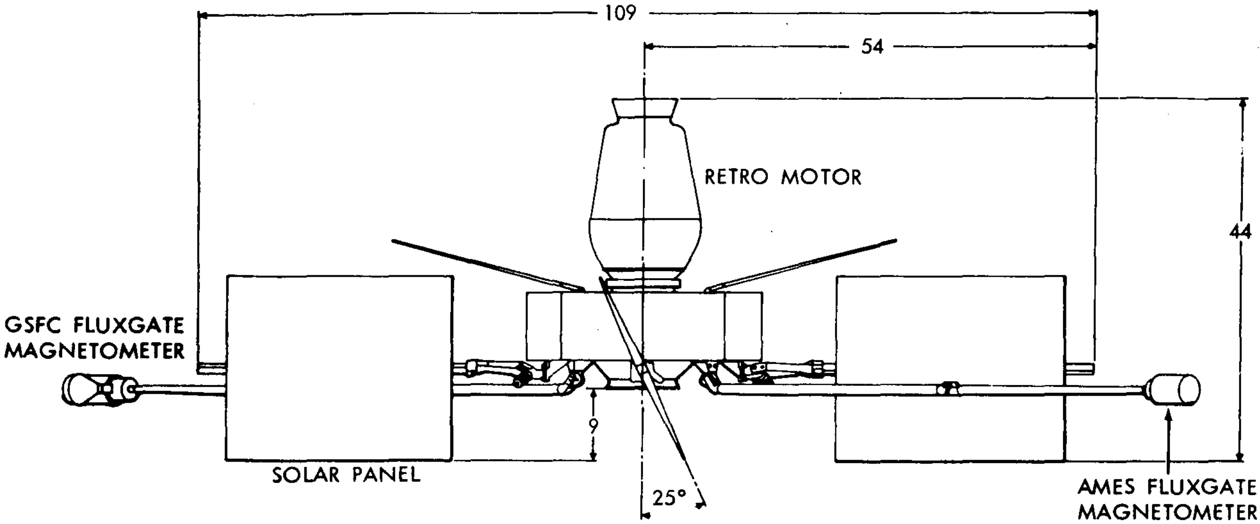
Contamination Monitor

The IMP-E carries a contamination monitor designed to determine the source of contamination which degraded the thermal coatings on the top cover of the IMP-D. Information from this monitor should prove useful in eliminating the contamination source on future spacecraft.

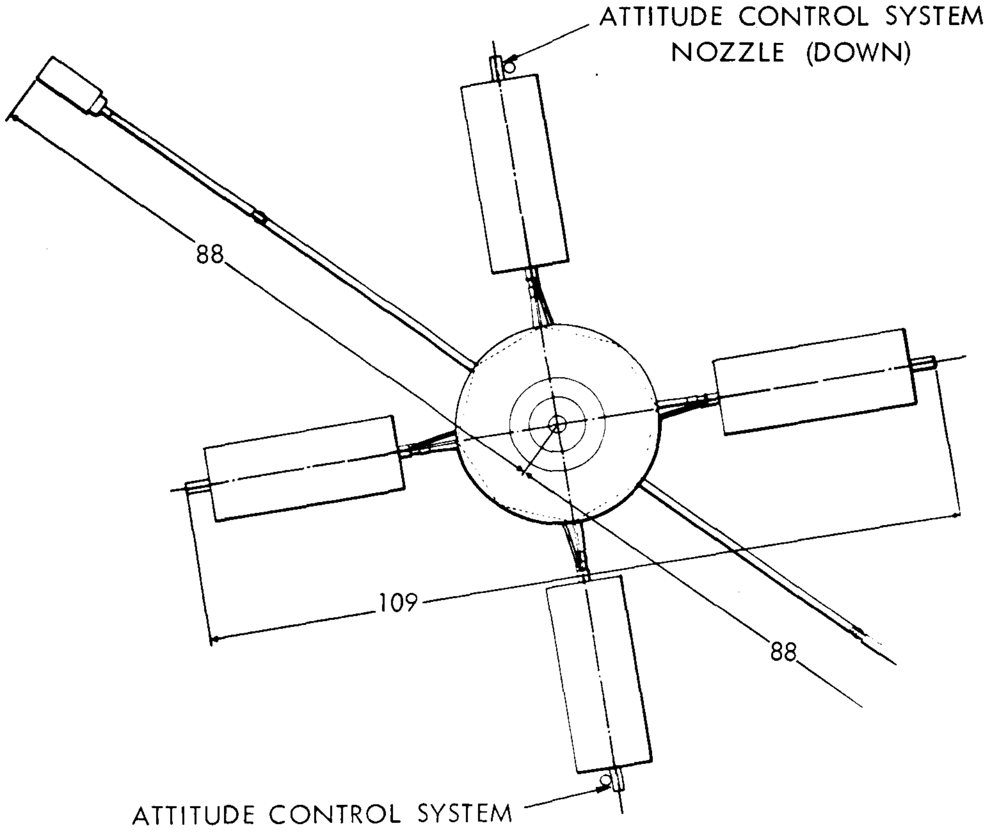
The monitor system is located on the outboard edge of the spacecraft's top cover. It consists of associated electronic and a collimated light source shining on a highly polished surface which reflects the light through focusing lens onto a solar cell. If a contaminant coats the polished surface, the change in the reflectivity of the surface will be detected.

The monitor will operate until fourth stage separation. It will use part of the telemetry data assigned to the MIT experiment while in operation.

ANCHORED INTERPLANETARY MONITORING PLATFORM



* MEASUREMENTS SHOWN IN INCHES



EXPERIMENTS

Magnetic Field Experiments

The basic device for measuring magnetic fields is the magnetometer. Two magnetometers--both of the fluxgate variety--are carried by the IMP. They were contributed by the NASA Goddard Space Flight Center and the NASA Ames Research Center.

The Goddard Magnetometer. This device consists of a boom-mounted sensor unit located about seven feet from the center of IMP-E. Electronics for the device are mounted in the main body. It consists of three orthogonally-mounted fluxgate sensors, two of which are mounted perpendicular to the spacecraft spin axis and one parallel to the spin axis. A flipper system will rotate the two sensors about 90 degrees each day to permit calibration of the sensors which are parallel to the spin axis.

This very sensitive device will be able to measure spatial and temporal variations of interplanetary and lunar magnetic fields in ranges of from 0.1 to 64 gammas.

The Ames Magnetometer. This device is also boom-mounted and is a three-component fluxgate device with a flipper mechanism.

The sensors are arranged so that one is parallel to the spacecraft spin axis and two are perpendicular to the spin axis. A flipper device reorients the array every 24 hours by rotating two sensors about 90 degrees to permit calibration.

This magnetometber is sensitive to magnetic fields from 0.2 to 200 gammas. In addition to measuring interplanetary and lunar magnetic fields, the Ames magnetometer is designed to obtain information on the interaction of the solar wind with the lunar magnetic field.

Radiation Experiments

Three different radiation detecting experiments will be flown on the IMP-E. They include an energetic particles experiment designed by the University of California; an electron and proton experiment from the University of Iowa; and a thermal ion and electron experiment from the Goddard Space Flight Center.

<u>Energetic Particles Experiment</u>. Designed and built by the <u>University of California</u> at Berkeley, this experiment has the following objectives:

* Measurement of low energy solar electrons. Recently, electrons with energies of 40 KeV were discovered being emitted from solar flares. This experiment will provide more information on solar and interplanetary correlations of these particles, their energy and spatial distribution.

* The study of energetic electron fluxes in the geomagnetic tail of the Earth's magnetosphere. From Explorer XVIII (IMP-I) measurements it was found that isolated fluxes of high energy electrons occasionally appear in the geomagnetic tail. It is hoped data from IMP-E will help in determining how these electron "island" fluxes originate and what significance they have in relation to other phenomena in this region of space.

* Low energy solar flare protons measurements will be conducted and the time history of these events obtained in detail.

* An ion chamber included with the experiment will provide a monitor of the galactic cosmic ray intensity and of solar protons above 12 MeV.

<u>Electrons and Protons Experiment</u>. Contributed by the <u>University of Iowa</u>, the basic objectives of this experiment are to:

* Study the spatial, temporal and angular distribution of electrons with energies exceeding 40 KeV in the magnetospheric wake of the Earth at distances up to 60 Earth radii.

* Search for electrons with energies exceeding 40 KeV in the wake of the Moon, and to conduct a detailed study of their distribution, if in fact, intensities of this level are detected.

* Study the incidence and intensity of low-energy solar cosmic rays versus time profile (protons and alpha particles separately) in interplanetary space, and determine their energy spectra and angular distribution.

* Study solar X-Rays in the 0-14 Angstrom range.

The experiment consists of a series of three electron devices having different view angles.

Thermal Ion and Electron Experiment. Designed and built by the Goddard Space Flight Center, this experiment has the following objectives:

* To measure low energy electrons and ions in the vicinity of the Moon.

* To detect the presence or absence of a lunar magneto-sheath and/or shock front.

* To observe the flow of the solar wind around the Moon.

* To make a comparison with data from the MIT plasma probe to determine if the observed electron high energy component as measured by an integral spectrum experiment can be interpreted in terms of solar wind electron temperature and number density.

The sensor for this experiment is also of the Faraday cup variety.

Solar Wind Experiment

Plasma Probe. The single solar wind experiment onboard IMP-E is called a plasma probe. It was provided by the Massachusetts Institute of Technology and is intended to measure the following phenomena:

* Angular distribution of the total proton flux in the equatorial meridian plane of the spacecraft.

* Energy distribution of the proton flux at or near the same angle as the peak of the total proton flux.

The sensor, a Faraday Cup, is mounted with its direction of view at right angles to the spin axis of the spacecraft. As it rotates with the spacecraft, the variation of the signal with time will be determined by the directional characteristics of the plasma in the equatorial plane and by the angular acceptance function of the sensor itself. The experiment will measure the energy spectrum and angular distribution of the proton and electron flux of the plasma in the range of 100 KeV to 5 KeV.

Cosmic Dust Experiment

Micrometeorite Flux Experiment. The single cosmic dust experiment onboard the IMP-E was provided by Temple University at Philadelphia, Pa. It will measure the momentum, kinetic energy and velocity of individual dust particles and approximate their point source.

It consists of two independent detectors: one directional and one nondirectional. Both will measure dust particle velocities from one to 31 miles per second and masses weighing from one ten-trillionth of a gram up to one-billionth of a gram.

Information from this experiment will aid scientists in calculating:

--Perturbations of the dust-particle distribution in cislunar space;

--Distribution and source (Moon or deep space) of dust particles in the vicinity of the Moon;

--Dust particles associated with meteor streams (both known streams and streams not detectable with ground-based equipment);

--The nature of dust-particle mass distribution in interplanetary space;

--The effects of the geomagnetic tail and wake on dust-particle distribution and direction at lunar distances.

Passive Experiments

The IMP-E passive experiments will use telemetry and range and range-rate signals as data sources to study selenodesy and the lunar ionosphere. They consist of the following:

* A Stanford University study to analyze the spacecraft telemetry signal and determine the effects of the lunar ionosphere on radiowave propagation.

* A University of California (Los Angeles) study will analyze variations in the range and range-rate tracking data to obtain selenodetic information.

Solar Cell Damage Experiment

The solar-cell damage study is a Goddard Space Flight Center engineering experiment which will provide information on radiation damage to solar cells and solar-cell cover glass of varying thicknesses and compositions, as well as on the protection afforded solar cells by various types of cover glass.

An area on the spacecraft main body will carry a panel of four groups of 16 one-by-two centimeter n-on-p silicon solar cells. One group of cells will be unshielded. The second will have an integral 25-micron cover glass. The third will have a six-mil fused silica cover glass. The fourth group will have a six-mil microsheet cover.

The 16 solar cells composing each group will be series-connected to a 60-ohm precision resistor of the size required to produce a 4.0- to 4.5-volt output under "space" conditions with normal illumination. The solar cells selected are production items of a type which have undergone extensive laboratory testing to determine electron and proton effects. Therefore, output variations among solar-cell groups can be related to solar-cell or solar-cell cover-glass damage. A thermistor imbedded in the solar-cell panel just under the cells will monitor variations in experiment temperature.

To assure experiment accuracy, the cell groups will be calibrated for illumination, angle of incidence, and temperature effect, both after environmental testing and before flight.

THE DELTA LAUNCH ROCKET

The IMP-E will be launched by NASA's Improved Delta rocket.

The launch vehicle, including a thrust-augmented Thor first stage, the enlarged Delta second stage, and the FW-4 third stage, is known as the Thrust-Augmented Improved Delta (TAID).

Delta project management is directed by the Goddard Space Flight Center, Greenbelt, Md. The Douglas Aircraft Co., Santa Monica, Calif., is the prime contractor.

Delta Statistics

The three-stage Delta for the IMP-E mission has the following characteristics:

Height: 92 feet (includes shroud)

Maximum Diameter: 8 feet (without attached solids)

Liftoff Weight: about 75 tons

Liftoff Thrust: 333,820 pounds (including strap-on solids)

First Stage (liquid only): Modified Air Force Thor, produced by Douglas Aircraft Co., engines produced by Rocketdyne Division of North American Aviation.

Diameter: 8 feet

Height: 51 feet

Propellants: RP-1 kerosene is used as the fuel and liquid oxygen (LOX) is utilized as the oxidizer.

Thrust: 172,000 pounds

Weight: Approximately 53 tons

Strap-on Solids: Three solid propellant Sergeant rockets produced by the Thiokol Chemical Corp.

Diameter: 31 inches

Height: 19.8 feet

Weight: 27,510 pounds (9,170 each)

Thrust: 161,820 pounds (53,940 each)

Second Stage: Produced by the Douglas Aircraft Co., utilizing the Aerojet-General Corp. AS110-118 propulsion system; major contractors for the auto-pilot include Minneapolis-Honeywell, Inc., Texas Instruments, Inc., and Electrosolids Corp.

Propellants: Liquid -- Unsymmetrical Dimethyl Hydrazine (UDMH) for the fuel and Inhibited Red Fuming Nitric Acid for the oxidizer.

Diameter: 4.7 feet (compared to 2.7 feet for the earlier Deltas)

Height: 16 feet

Weight: 6½ tons (compared to 2½ tons for the earlier Deltas)

Thrust: about 7,800 pounds

Guidance: Western Electric Co.

Third Stage: United Technology Corp., FW-4

Thrust: 5,450 pounds

Fuel: solid propellant

Weight: about 660 pounds

Length: about 62 inches

Diameter: 19.6 inches

IMP-E PROJECT OFFICIALS, EXPERIMENTERS, AND MAJOR CONTRACTORS

NASA Headquarters

Dr. Homer E. Newell, Associate Administrator for Space Science and Applications.

Jesse E. Mitchell, Director, Physics and Astronomy Programs.

Frank W. Gaetano, Associate Program Manager.

Dr. A. Schardt, Program Scientist.

Robert W. Manville, Delta Program Manager.

Goddard Space Flight Center

Paul G. Marcotte, Project Manager.

Jeremiah J. Madden, Assistant Project Manager.

Dr. Norman F. Ness, Project Scientist.

John J. Brahm, Project Coordinator.

Peter L. Luppino, Tracking and Data Manager.

William B. Schindler, Delta Project Manager.

Kennedy Space Center

Robert H. Gray, Assistant Director, Unmanned Launch Operations, Kennedy Space Center.

Experimenters

Active

Dr. K. A. Anderson, University of California (Berkeley)
Energetic Particle Flux.

Dr. James A. Van Allen, University of Iowa
Electrons and Protons.

Dr. H. S. Bridge, Massachusetts Institute of Technology
Plasma Probe.

Dr. Charles P. Sonett, NASA Ames Research Center
Magnetometer.

Dr. Norman F. Ness, NASA Goddard Space Flight Center
Magnetometer.

Dr. J. L. Bohn and W. M. Alexander, Temple University (Philadelphia) Micrometeorite Flux Experiment.

Gideon P. Serbu and Dr. Eugene J. Maier, NASA Goddard Space Flight Center Thermal Ion and Electron.

Luther W. Slifer, Jr., NASA Goddard Space Flight Center
Solar Cell Damage.

Passive

Dr. A. M. Peterson, Stanford University
Lunar Ionosphere and Radiowave Propagation
(Passive experiment using spacecraft telemetry signal)

Dr. W. M. Kaula, University of California (Los Angeles)
Selenodetic Studies (Passive experiment based on analysis of range of range-rate tracking data)

Major Contractors

Aerospace Division, Westinghouse Electric Corp., Baltimore, Md.
Space Integration.

Douglas Aircraft Co., Santa Monica, Calif.
Delta Rocket.

Thiokol Chemical Corp., Elkton, Md.
Thiokol TE.M. 458 Retro Motor.

IMP-E FACT SHEET

Launch: Four-day launch window (three minutes each day) beginning July 19, 1967, at Launch Complex 17, Cape Kennedy, Fla.

Launch Rocket: Thrust-Augmented Improved Delta (TAID), with Thiokol retromotor mounted in base of spacecraft to achieve lunar orbit.

Lunar Orbit: Apolune: less than 28,500 statute miles
Perilune: greater than 300 statute miles
Period: between 10 and 70 hours
Inclination: between 140 and 180 degrees to Moon's equator

Earth Orbit: Apogee: about 280,000 statute miles
Perigee: about 18,700 statute miles
Period: more than two weeks
Inclination: 28 to 31 degrees initially

Spacecraft Weight: 230 pounds including 82-pound retromotor, with about 30 pounds of experiments.

Main Structure: Octagon shape, 28 inches by 28 inches, 34 inches high (from top of third stage adapter to top of retromotor).

Appendages: Four rectangular-shaped solar panels.
Four transmitting antennas, 16 inches long.
Two hinged magnetometer booms about seven feet long.

Power System: Power Supply: Solar cells mounted on four panels to supply average power of 38 watts with one silver cadmium battery capable of supplying 45 watts of power for three and one-half hours.

Communications and Data-Handling System:

Telemetry: Pulsed-frequency modulation phase-modulated (PFM-PM).

Transmitter: Seven watt output at a frequency of 136:110 mc

Encoder: PFM with digital data processor (DDP) for accumulation and storage of data.

-more-

Tracking and Data-Acquisition Stations: Space Tracking and Data Acquisition Network (STADAN) operated by Goddard Space Flight Center with primary stations located at:

Tracking: Carnarvon, Australia
Santiago, Chile
Tananarive, Malagasy
Rosman, North Carolina

Telemetry: Tananarive, Malagasy
Johannesburg, Republic of South Africa
Santiago, Chile
Orroral, Australia
Rosman, North Carolina
Fairbanks, Alaska

-end-